

ON THE ANATOMY AND RELATIONSHIPS OF *VOLUTA MUSICA*,  
LINN.; WITH NOTES UPON CERTAIN OTHER SUPPOSED  
MEMBERS OF THE VOLUTIDÆ.

By S. PACE, F.Z.S., etc.

Read 13th December, 1901.

PLATE II.

ALTHOUGH the shell of *Voluta musica* is such an exceedingly common one in collections, the living animal has not as yet been observed; while only a single example, having the soft parts preserved, appears to have hitherto found its way into the hands of a conchologist. This was obtained by M. Marie at the Île des Saintes, Guadeloupe, and forwarded by him to Dr. P. Fischer, who described (5) and figured the external characters and the radula. The specimen was, however, too badly preserved for Fischer to make out anything further concerning its internal anatomy.

In view of this almost complete ignorance regarding the structure of *V. musica* the late Mr. Martin F. Woodward, who for some time prior to his untimely death had been bestowing particular attention to the morphology of the rhachiglossate Prosobranchiata, made great efforts to obtain further material of this species. He was particularly anxious to examine the anatomy of *V. musica*, because he considered that in all likelihood this species, which must be regarded as the type of Linnæus' genus *Voluta*, was not at all intimately related to that possibly rather mixed assemblage of forms which are at present grouped together under the Volutidæ. The opportunity to test this surmise by actual dissection did not, however, occur; for when at length, through the instrumentality of his friend and former pupil Mr. W. G. Freeman, of the Imperial Agricultural Department, Barbados, and Mr. L. B. Brown, of Barbados, some specimens were obtained, these arrived in London at the same time as the news of the sad accident which has deprived malacological science of one of her most devoted and most able students.

The Volutes in question were subsequently kindly placed in my hands for examination by the executors of the late Mr. Martin F. Woodward, with the request that I would report upon them to the Society of which he had been the Secretary.

Whilst working at the anatomy of *Voluta musica*, I have, through the kindness of Mr. E. A. Smith, to whom my best thanks are due, also been enabled to examine the animal of *Neptuneopsis Gilchristi*, Sby., a spirit specimen of this rare mollusc having been recently acquired by him for the British Museum collection. This form had already been investigated by Martin F. Woodward (13), but he had only an imperfect example, the highly important buccal region having

been destroyed by a collector of radulæ. I also take advantage of the opportunity to add a few notes<sup>1</sup> regarding the morphology of certain other supposed members of the Volutoid series.

VOLUTA MUSICA, Linn.

The material at my disposal consisted of five examples, all of which were males, of the small pink variety. The shells, which will be deposited in the British Museum, measured from 4·3 to 5 cm. in length.<sup>2</sup> The animals were received in their shells. They had been preserved in formalin, but were not in very good condition for dissection; being much contracted, and in each case the visceral sac had entirely disappeared, decomposition having apparently set in before the animals were pickled.

*External characters of the Animal.*—As already mentioned, the external characters of this Volute have been pretty fully described by Fischer (5) from a spirit specimen; but the following particulars may be added to his account, bearing in mind that my material also was not fresh, but had been preserved in formol.

During life *V. musica* must present an exceeding handsome appearance. The dorsal surface of the foot is covered with large pigment spots, having the appearance of being contractile chromatophores, upon a speckled or splashed ground. The sole of the foot is similarly marked, but the markings are of a paler shade. In the preserved state the speckled markings are of a reddish-brown colour, while the larger spots are of a rich purple brown; but it is of course possible that the colours of the living animal may be altogether different. As was remarked by Fischer, the introvert presents the very unusual feature of being pigmented like the exterior of the body.

The *foot* is rounded posteriorly: anteriorly it is deeply notched, has the angles produced and the front margin duplicated. The *operculum* is mounted upon a distinct opercular pad, and placed transversely to the long axis of the foot. I could discern no trace of any *pedal pore*, but am not prepared to deny the existence of such a structure. The *appendages of the siphon* appear to be somewhat variable; and, as remarked by Fischer, they are of very unequal size. That on the right side is a small tongue-shaped structure lying entirely within the mantle edge; while the left one is about as broad as the siphon itself, and, arising about half-way along the latter, runs parallel with it to its extremity, thus producing the appearance of a cleft siphon. The siphon with its appendages is pigmented, except at its hinder angle,

<sup>1</sup> For the opportunity to examine such of the late Mr. Martin F. Woodward's dissections as are preserved in the Zoological Laboratory of the Royal College of Science, my thanks are due to Dr. G. B. Howes; and I am indebted to Mr. E. A. Smith for permission to work through Dr. Gray's original preparations of radulæ which are now in the British Museum.

<sup>2</sup> It is very probable that this diminutive size of certain specimens of *V. musica* is a sexual character. Fischer (4) has recorded that the male of *Lyria deliciosa* has a smaller shell than has the female; and this type of sexual dimorphism would appear to be not at all uncommon among Prosobranchs.

where it is greatly thickened to form a definite posterior siphon, which shows slight pigmentation and is supported on cartilage. The *mantle-edge* is thin and unpigmented. In the contracted state, the *penis* is hatchet-shaped and directed backwards; it lies entirely under cover of the mantle.

*Pallial Complex.*—The condition of the organs of the pallial complex presents no unusual features. The bipectinate *osphradium* is highly developed, and its foliæ are darkly pigmented. The laminae of the *ctenidium* are triangular in shape and unpigmented. The *hypobranchial gland* is well developed. Its secretion was at first (as preserved in formol) of a rich purple colour, but this changed to a vivid green under the action of fresh water.

*Introvert.*—The introvert is of comparatively large size and almost completely eversible. In this condition (Fig. 1) it appears as an elongated structure, which is flattened dorso-ventrally and slightly curved upwards. Attention has already been directed to the pigmentation of the outer surface of the introvert. In the retracted state it lies entirely within the body-cavity, passing to the right side over the œsophagus, and forming a curved lenticular mass which occupies the greater part of the anterior region of the body-cavity and lies transversely to the long axis of the body.

The musculature of the introvert is not greatly developed; it consists mainly of a series of strands inserted along the greater curvature of the introvert-sheath.

*Alimentary Canal.*—The mouth appears as a conspicuous vertical slit at the extreme end of the everted introvert. It appears to be supported by a couple of small masses of cartilage. The œsophagus, in the everted condition of the introvert, passed straight back, without any convolution, from the mouth to the stomach; and it appeared to be of pretty uniform calibre throughout the whole extent of its course. When the introvert is retracted, the œsophagus, after emerging from the introvert, passes sharply forward underneath the latter and to the right side, as far as the nerve collar, where it makes another sudden bend and resumes its backward direction.

*Leiblein's Gland.*—There is a greatly developed œsophageal diverticulum, forming a very prominent mass lying dorsad to the œsophagus (Fig. 2). It is a very stout, much convoluted, tubular structure, of large calibre, larger than that of the œsophagus, arising immediately behind the nerve-ring, and terminating in a but slightly enlarged, thick-walled, spheroidal sac. Its convolutions are bound up in exceedingly tough and closely adherent connective tissue; and they present a very characteristic glistening appearance. In colour the terminal segment of the œsophageal cæcum is pure white and somewhat translucent, while its duct is yellowish and opaque. The enlarged terminal segment is closely bound up with the œsophagus; but its lumen is certainly not in actual communication with that of the gut at this point.

*Salivary Glands.*—As probably obtains in the majority of the higher Prosobranchiata, two pairs of so-called salivary glands are represented; and both pairs lie entirely in front of the nerve-collar.

The racemose glands, which are the homologues of the single pair met with in the less specialized forms, present a peculiar 'fluffy' appearance, and in colour are translucent white, while the tubular glands are yellowish and opaque.

The ducts of the racemose glands are at first straight, of fairly large calibre, and quite free from the œsophagus, standing out at right angles, one on each side of the latter, at a point just outside where it emerges from the introvert. After meeting the œsophagus the salivary ducts are continued forward as very delicate convoluted tubes of diminishing calibre, which run along one on each side of the œsophagus, and are closely bound up with it.

The tubular glands (Fig. 2) lie entirely within the introvert when the latter is extruded, but upon its retraction they project freely into the body-cavity. They are convoluted throughout the major portion of their course, but for a short distance from their distal extremities, which are marked by a slight pyriform enlargement, they are quite straight. This short terminal segment is directed forwards: the tube then bends sharply upon itself, and becomes much convoluted, while its calibre undergoes regularly progressive diminution. Upon nearing the radula-sac, the tubular salivary glands, now extremely fine, pass suddenly under the œsophagus, and meeting, give off at right angles a single, very delicate duct, which passes forward under the radula-sac.

*Radula*.—I am not at all certain that the radula of *Voluta musica* is represented with perfect accuracy by the familiar formula 0-1-0, since the uncleaned preparation of this organ showed what may possibly be the extremely minute, shapeless vestiges of lateral teeth. The functional teeth (Fig. 4) are of the 'rastriform' type, so well described and figured by Fischer (5). The number of denticles appears to be inconstant: Fischer's example showed twelve well-formed cusps, with, on one side, three intermediate denticles.

*Nervous System*.—The most important point regarding the nervous system (Fig. 3) is the quite considerable length of the right pleuro-visceral connective; the supra-intestinal ganglion occupying its more normal position close to the osphradium, instead of being intimately related to the nerve-ring, as in the *Volutes* described by Martin F. Woodward.

*Conclusions*.—As will be seen, *Voluta musica* does not differ in its anatomy from those few *Volutidae* of whose structure any details are at present known, to such an extent as to justify its separation from the other members of that group, the most evident deviation being in the radula; but even in this feature there are indications, as will be pointed out, of the existence of an intermediate type in *Lyria deliciosa*, and further links may reasonably be anticipated to exist among the large number of species of whose anatomy nothing is as yet known.<sup>1</sup> Moreover, it must be remembered that the taxonomic

<sup>1</sup> Since this paper was written I have been enabled to examine the radula of *Lyria melus*, Lam.: this exhibits a most perfect intermediate stage between the *V. musica* and the *Lyria deliciosa* types.

value of the radula in the Prosobranchiata has been considerably overrated; and that the more important characters are probably those which are afforded by the alimentary canal with its appended glands, and by the nervous system. In the morphology of its alimentary apparatus, *V. musica* is in complete accord with what is known in other forms referred to the Volutidæ; while, as regards its nervous system, the presence of a definite right pleuro-visceral connective is suggestive of a more primitive condition than is met with in any known form other than *Melo Neptuni* (1, figs. 74 and 75).

#### LYRIA DELICIOSA, MONTZ.

The anatomy of this form was investigated by P. Fischer (4); but, although he would seem to have had ample material, his description is anything but complete.

*Leiblein's Gland.*—Fischer makes no mention of the existence of an cesophageal caecum in *Lyria*: can it be that it is absent or insignificant in this form; or, may it not rather be, that what is described as the stomach is in reality formed by the convoluted Leiblein's gland bound up with the gut?

*Salivary Glands*—Fischer describes the tubular salivary glands, which he states open one on each side<sup>1</sup> of the radula-sac, but he says nothing of the normal acinose ones, which are, presumably, also present.

*Radula.*—Fischer's figure of the radula is a somewhat unsatisfactory one, but the enlarged, straight base of the tooth, and the small and equal size of its cusps, are rather suggestive of an approximation towards the *V. musica* type.

#### NEPTUNEOPSIS GILCHRISTI, SBY.

My specimen, like that described by Martin F. Woodward (13), was a female. It was preserved in spirit, had been removed from its shell,<sup>2</sup> and was minus the visceral sac when I received it. Otherwise, notwithstanding the fact that the animal had been macerated for a fortnight in order to facilitate removal from its shell, the tissues were in fairly good condition for dissection.

*External characters of Animal.*—The head is produced into two enormous, expanded, tentacular lobes: these, although flattened, are stout and solid, and have their borders rounded; they are separated in the middle line by a deep notch, which is continued over the dorsal surface of the head as a shallow median groove. It is noteworthy that the head is not quite symmetrical, the right tentacle, and more particularly the eye-stalk, being more developed than the left. The general shape of the head is shown in Fig. 5, in which the position of the rhynchostome, or false mouth, is also indicated.

<sup>1</sup> It is probable that the tubular 'salivary glands' in all cases open in advance of the radula-sac, and not at its posterior extremity.

<sup>2</sup> The register number of the shell, which is in the British Museum, is "1901: 10·29·10."

The *foot* is bilobed anteriorly, and its front margin is duplicated. It bears a conspicuous *pedal pore* on the sole at about its middle. The *opercular pad* is large. The *siphon* is very short, and the edge of the mantle is continued round its base as a very slight and inconspicuous collar. Martin F. Woodward has stated that the siphon is devoid of appendages: my specimen, however, showed a prominent tongue-shaped outgrowth of the left border of the siphon at its base, and I have since made out the existence of a similar structure in Woodward's specimen, in which its presence had been obscured by coagulated mucus. The posterior siphon is represented by but a slight groove.

The animal appeared to have been entirely destitute of colour-markings. The eye-spots are red in the preserved specimen.

*Introvert.*—The rhynchostome, or external opening of the introvert-sheath, is rounded and quite simple. The eversible portion of the introvert is conical in form, somewhat flattened dorso-ventrally, and with the base of the cone, not at right angles to its axis, but facing downwards. Its walls are enormously thickened and muscular, especially at its base. The musculature of the introvert consists of two lateral series of rounded bundles arising on the body-wall, and inserted at close intervals along the sides of the introvert-sheath (Fig. 6). These bundles become more developed towards the base of the introvert, which is further provided with a powerful retractor, arising on the roof of the body-cavity and inserted dorsally on to the introvert-sheath.

*Alimentary Canal.*—The mouth is a small vertical slit at the extreme end of the proboscis: it is destitute of jaws and unsupported by cartilage. The buccal mass is well developed, measuring about 9 mm. in length. Its roof is extremely thin and transparent, and so closely applied to the œsophagus as to give the buccal mass a crescentic transverse section. The initial segment of the œsophagus is perfectly straight, and practically buried up in the muscular roof of the introvert. After passing out of the introvert the œsophagus becomes somewhat enlarged and very thick-walled. In the contracted condition it passes sharply forward, to the right of the retracted introvert, as far as the nerve-ring. Passing through this, it makes another sharp turn backwards, and appears to be continued without any break as Leiblein's gland; the œsophagus appearing to come off below, immediately behind the nerve-ring, as a thin-walled, and comparatively insignificant, outgrowth of what is in reality its own diverticulum. The explanation of this apparent anomaly would seem to be that here, as in perhaps the majority of instances, the point of separation of the œsophageal diverticulum from the œsophagus is not its true point of origin, the latter being situated far forward in advance of the nerve-collar, namely, at the point of apparent thickening of the œsophagus. From here, backwards, the œsophagus is so closely bound up with its diverticulum as to be indistinguishable from it by ordinary dissection. After the separation off of Leiblein's gland the œsophagus undergoes no further convolution; but its walls soon become so exceedingly thin

as to appear quite membranous, and the lumen of the gut is at the same time increased.

*Salivary Glands.*—Two pairs of so-called salivary glands are present (Fig. 7); the one pair acinose, the other tubular. Both pairs are situated entirely in advance of the central nervous system.

The acinose glands occupy a position immediately in front of the nerve-ring. Their acini are much mixed up, but they are so exceedingly brittle that I was unable to determine whether there is any actual communication between the glands of the right and left sides, such as exists in certain *Toxoglossa*. The racemose glands are in close contact with the œsophagus, and only an extremely short tract of their ducts is free. After becoming applied to the œsophageal wall the salivary ducts become exceedingly delicate, so delicate that I was quite unable to follow them forward to their pharyngeal openings.

The tubular glands are highly developed. That part outside the introvert is of large calibre, and lies perfectly freely within the body-cavity. As is the case in *V. musica*, the tubular glands are sharply bent back upon themselves at a short distance from their distinctly enlarged distal extremities. They are of gradually decreasing calibre, and become very delicate within the introvert. Upon reaching the end of the radula-sac, the glands, now of extreme tenuity, pass under the retractor muscle of the buccal mass, and there unite to form a single convoluted duct of increased calibre. This convoluted duct forms a broad strap-shaped mass lying beneath the buccal mass, and might very easily be mistaken for an anterior buccal retractor. It was possible to trace the duct right forward as far as the lips; and it appeared to open into the mouth well in advance of the buccal mass, but I was not able to make out its actual orifice with certainty; anyhow, unless the duct doubles back again and is excessively delicate, it certainly does not open upon the floor of the buccal mass, as has been described, possibly erroneously, in other forms.

*Radula.*—The radula contained 65 rows; and the most important point which I have been enabled to make out with regard to this interesting form is the fact that the true formula of the radula (Fig. 8) is 1-1-1, and not 0-1-0 as described<sup>1</sup> by Sowerby (11). I had rather anticipated finding some indication of lateral teeth in this form, which in the characters of its shell and operculum approximates rather towards the fusoid type; and therefore took particular pains in the investigation of this structure, otherwise its true nature would most certainly have escaped me. In the fresh state<sup>2</sup> the lateral

<sup>1</sup> Sowerby's figure shows such discrepancies from my preparation, that I venture to question whether the radula of some other species, e.g. *Cymbiola ancilla*, may not have been accidentally substituted for that of *Neptunopsis* by the mounter of Sowerby's slide.

<sup>2</sup> A radula should in all cases be examined *before* cleaning with potash, since vestigial teeth such as those in question may be much too tender to withstand the action of this reagent. It is not sufficiently realized that potash is not without effect upon chitinous material; but that, on the contrary, delicate structures may be entirely destroyed by its use.

teeth, though quite unmistakably present, were plainly seen to be greatly degenerate, and are probably quite functionless. They were of extreme tenuity compared with the very massive rhaehidian tooth, and their contours were ragged.<sup>1</sup> Under the action of, even cold, caustic potash they were so very speedily disintegrated, that I had no time to make a drawing of them before they were entirely destroyed.

VOULITILITES ABYSSICOLA, Ad. & Rvc.

I have examined the dissected specimen described by Martin F. Woodward, and may add the following to his account (13) of this form.

*External characters of Animal.*—The *tentacles* and *eye-stalks* are quite rounded, and thus unlike those of any other Volute hitherto recorded. The *foot* is scarcely at all auriculated; its front margin is duplicated. I could find no trace of any *pedal pore*; and I am confident, so beautifully are the specimens preserved, that I should have been able to detect an opening had one been present. The *siphon*, which is quite devoid of tentacular appendages, is surrounded by a collar-like prolongation of the mantle.

CYMBIOLA ANCILLA, Sol.

The following few notes, based upon the material described by Martin F. Woodward, may be added to his description (13).

*External characters of Animal.*—The front edge of the foot is duplicated. The appendages to the siphon are of very nearly equal length, and are quite insignificant by comparison with the siphon itself.

*Leiblein's Gland.*—This is much convoluted, and the convolutions are bound up together in very tough connective tissue. The duct terminates in a muscular sac of not much larger calibre than the duct.

*Salivary Glands.*—The tubular glands each terminate in a distinct pyriform enlargement.

*Radula.*—Mr. Martin F. Woodward did not consider it necessary to figure the radula, since it is of the same type as that of the majority of the Volutes whose dentition has been examined. In my opinion, however, it is desirable that, wherever possible, the detailed characters of this organ should be placed upon record, since these details will probably assume an increased importance in the future. I have therefore made a camera-lucida drawing (Fig. 9) from Woodward's preparation. It should be noted that the central cusp bears no dorsal groove, but is quite solid and rounded. The radula, as mounted, contains 43 teeth, and it appears to be complete.

VESPERTILIO VESPERTILIO, Linn.

*Radula.*—For comparison with the radula of *Amoria Turneri*, I have thought it advisable to figure a portion of the original preparation described by Dr. Gray (7) as that of *V. vesperilio* (Fig. 10). The

<sup>1</sup> It is noteworthy that degenerate lateral teeth have been recorded by Schaeck (10) as existing in ~~*Amphiphaedusa maculosa*, Brink.~~

*Semivoluta Sturbi* Martens



grooved condition of the central cusp, not indicated by Gray or Troschel (12), should be noted. As mounted by Dr. Gray the radula consisted of 26 teeth.

#### AMORIA TURNERI, Gray.

*Radula*.—The original preparation figured by Dr. Gray (6 ; p. 133, fig. 5) as the radula of this species shows, as I had surmised, that his figure does not well interpret the structure of the tooth. I have therefore refigured it (Fig. 11). It will be seen that there is, after all, nothing so very peculiar about the radula of *A. Turneri*; and that it differs from that of *V. vespertilio* only in having the base of the tooth even more arched than it is in the latter form, and in the complete suppression of its lateral cusps with accompanying greater development of the central cusp.

#### VOLUTOMITRA GREENLANDICA, Beck.

*Radula*.—Martin F. Woodward (13) and others have assumed that the figure given by Troschel (12 ; pl. v, fig. 5*b*) represented a normal, triserial radula. This figure, however, in reality demonstrates the effect of pressure upon the cover-glass ; for the apparent lateral teeth are in reality but the broken-off bases of the highly arched rhachidian tooth, which appears to be alone present. This tooth would seem to be in every respect comparable with that of *Amoria Turneri*.<sup>1</sup>

#### HALIA PRIAMUS, Meusch.

There now seems to be no reasonable doubt as to the correctness of the reference of this form to the Volutidæ. The published accounts of its anatomy are, however, obviously based upon misconceptions as to the homologies of the parts ; and these inaccuracies have unfortunately received the imprimatur of the text-books.

*Alimentary Canal and Leiblein's Gland*.—Fischer (3) regarded the convolutions of the œsophageal cæcum as being those of the intestine ; and both he and Poirier (8) have mistaken for the stomach what is without doubt only the enlarged terminal segment of this diverticulum. The true stomach is figured by Poirier (8 ; pl. ii, fig. 4) occupying its normal position, and with the usual relationships ; but it is regarded by him merely as a bend of the intestine. The condition of Leiblein's gland in this form is generally regarded as quite a peculiar one, Poirier having described it as being in open communication with the lumen of the alimentary canal, at its enlarged distal end as well as proximally. Now, is it not in the highest degree probable that the actual facts of the case are, that the terminal enlargement of the œsophageal cæcum is so closely bound up with the œsophagus, that in the process of dissection an apparent second opening into the gut has been artificially formed at this point ? It is an exceedingly easy matter to fall into error regarding the openings of minute ducts ; thus, I was myself very nearly

<sup>1</sup> I had hoped to refigure the radula from Dr. Gray's preparation, but an examination of the slide, a temporary mount, shows that the radula itself has unfortunately disappeared.

recording such a second communication between the œsophagus and its cæcum in *V. musica*. The only really conclusive method of determining points such as the one in question is by serial-sectioning.<sup>1</sup>

*Radula*.—The radula appears to be in every respect similar to that of *Amoria* Fischer (3) undoubtedly examined this organ from its lower surface, and arrived at quite an erroneous conclusion as to its true nature, since he describes it as of the formula 1-0-1, and as having a deep median furrow. Poirier (8) gave the formula as 1-1-1; but the supposed laterals, like those of *Volutomitra*, are almost certainly only the broken-off ends of the highly arched base of the rhachidian tooth.

METZGERIA ALBUS (Jeffer.) [= *Meyeria pusilla*, Sars].

May not this form, which by Sars (9) was referred to the Muricidæ, be more closely related to the Volutidæ? The shell has columella plaits which are quite as strongly developed as they are in some admitted Volutes; and the obviously inexact figure given by Sars of the alimentary canal is somewhat reminiscent of the Volutoid type, while the radula does not appear to be so very unlike that of *Psephæa* or *Volutilithes*.

#### REFERENCES.

1. *Bouvier, E. L.*: Système nerveux, morphologie générale, et classification des Gastéropodes Prosobranches: Ann. Sci. Nat., Zool., sér. vii, tom. iii (1887).
2. *Bouvier, E. L.*: Sur le Siphon œsophagien des Marginelles: Bull. Soc. Philom., sér. viii, tom. i (1889), pp. 13-14.
3. *Fischer, P.*: Monographie du genre *Halia*, Risso (*Priamus*, Beck): Journ. de Conch., tom. vii (1858), pp. 141-158, pl. v.
4. *Fischer, P.*: Sur l'anatomie des *Lygia*: Journ. de Conch., tom. xv (1867), pp. 349-356, pl. xiii.
5. *Fischer, P.*: Sur l'Animal du *Voluta musica*, Linn.: Journ. de Conch., tom. xxvii (1879), pp. 97-106, pl. v.
6. *Gray, J. E.*: On the division of Ctenobranchous Gasteropodous Mollusca into larger groups and families: Ann. & Mag. Nat. Hist., ser. ii, vol. xi (1853), pp. 124-133.
7. *Gray, J. E.*: On the Teeth of the genus *Mitra*. Lamarek: Ann. & Mag. Nat. Hist., ser. ii, vol. xii (1853), pp. 129-130.
8. *Poirier, J.*: Recherches anatomiques sur l'*Halia Priamus* (Risso): Bull. Soc. Malac. France, tom. ii (1885), pp. 17-50, pls. ii-iv.
9. *Sars, A.*: Mollusca Regionis Arcticae Norvegiæ: Christiania, 1878.
10. *Schacko, G.*: Radula Untersuchungen: Conch. Mitth., Bd. i (1881), pp. 122-128, pl. xxiv.

<sup>1</sup> It may be noted that Bouvier (2) has recorded that in *Marginella cingulata* the œsophageal cæcum communicates with the œsophagus by two openings situated in close proximity to each other; and he regards the diverticulum as being in this case of a similar nature to that stated to exist in *Halia*, only that in *Marginella* the supposed loop has become obliterated by the fusion of its inner faces.

